

REMARKS

Claims 19, 57 and 65 have been canceled, and claim 16 has been amended. Claims 16-18, 21, 51-56, and 59-64, of which claim 16 is the only independent claim, are presented for examination.

Under 35 U.S.C. § 103(a), the Examiner has rejected claims 16, 21, 52, 53, 55-57, and 59-64 as being obvious over Japan 55-088266 (Japan '266) in view of U.S. Patent No. 6,203,941 (Reichert) and Sono-Tek Technology Review (Sono-Tek); claims 19 and 65 as being obvious over the same references, further in view of the allegedly admitted state of the prior art; claims 17, 18 and 51 as being obvious over Japan '266 in view of Reichert and Sono-Tek, further in view of U.S. 4,888,206 ("Hope"); and claim 54 as being obvious over Japan '266 in view of Reichert, Sono-Tek, the allegedly admitted state of the prior art and EP 898316 A1 ("EP '316"). Applicants attach a certified translation of the Japan '266 reference hereto. All discussion of Japan '266 herein refers to this translation.

Claim 16 has been amended to include the features of now-canceled claim 65. As amended, claim 16 recites applying an electrolyte to a surface in a battery container, the electrolyte being in the form of a spray formed by a vibratory nebulizer, wherein the surface is defined by a separator including a cellulose material.

None of the cited references discloses or suggests spraying an electrolyte in the form of a spray formed by a vibratory nebulizer to the claimed separator. For example, Japan '266 refers only to a "liquid absorber such as polypropylene non-woven fabric." (See Japan '266 at page 2.) And neither Reichert nor Sono-Tek cures the deficiencies of Japan '266. With regard to the Examiner's statement that "it would further have been obvious ... to also provide spraying electrolyte on the separator as suggested by the admitted state of the prior art...," the section of the specification to which the Examiner refers (page 1) does not so provide. That section instead discloses that a separator can be placed against a surface of a cathode, and that:

a small precharge of electrolyte is then added to wet the separator. The precharge is poured into the annular opening defined by the separator and *forms a small pool* at the bottom of the can from which it *wicks* into the separator after a period of time.

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Serial No. : 10/614,652  
Filed : July 7, 2003  
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Attorney's Docket No.: 08935-216002 / M-4925A

(Specification at page 1, emphasis added.) In other words, the Background section indicates that electrolyte is applied to a cellulose separator by allowing the separator to wick up the electrolyte over a period of time, not by spraying the electrolyte to a *surface* of the separator. There is no suggestion that applying an electrolyte by spraying it onto a surface of a cellulose separator would result in effective up-take of the electrolyte. Accordingly, for at least this reason, the claims are non-obvious over the combined references, and Applicants request that the rejections under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

For at least the reasons discussed above, Applicants believe the claims are in condition for allowance, which action is requested.

Please apply any charges or credits to deposit account 06-1050, referencing attorney docket number 08935-216002.

Respectfully submitted,

Date: January 17, 2006

  
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(19) Japanese Patent Office (JP)

(12) Official Gazette for Kokai Patent Applications (A)

(11) Japanese Patent Application Kokai Publication No.

Kokai No.: 1980(Sho55)-88266

(43) Kokai Publication Date: July 3, 1980

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(51) Int.Cl. <sup>3</sup>	Identification Symbol	JPO File Number
H 01 M 4/08		6821-5H
6/16		6821-5H

Request for Examination: Not Submitted Number of Claims: 1 (Total of 3 pages in the original Japanese)

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(54) Title of the Invention: Method for preparing non-aqueous electrolyte cell

(21) Application Filing No.: 1978(Sho53)-161377

(22) Application Filing Date: December 26, 1978

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(1)

Specification

1. Title of the Invention

Method for preparing non-aqueous electrolyte cell

2. Claims

1. Method for preparing non-aqueous electrolyte cell, the cathode active material of which consists of metal lithium, in which the electrolyte is sprayed in a mist-like form into the anode compound.

3. Detailed Explanation of the Invention

The present invention relates to a method for preparing non-aqueous electrolyte cell, the cathode active material of which consists of metal lithium.

In this type of cell, the cathode active material of which consists of metal lithium, in consideration of the significant chemical activity of the water and oxygen contained in the metal lithium, organic solvents are utilized as the electrolyte, and its assembly is conducted under an extremely dry atmosphere in which the relative humidity is 20% or less.

Thus, under such a dry atmosphere, particularly when the electrolyte is caused to penetrate into the anode compound, the electrolyte dissipates due to the evaporation; consequently, the desired cell functions were unobtainable, which was problematic.

(2)

In consideration of the problem stated above, the present invention has been designed in the following manner: in preparing non-aqueous electrolyte cell, the cathode active material of which consists of metal lithium, the electrolyte is rendered into a mist-like form and sprayed on the anode compound; thus, penetration of the electrolyte into the anode compound can be instantaneously facilitated to shorten the production time, as well as to prevent the reductions in and variations of cell properties caused through evaporation of the electrolyte.

In other words, the assembly of the non-aqueous electrolyte cell of this type is commonly conducted in the following manner: a metal net is spot-welded to a cathode can provided with a gasket, a lithium disk is placed and pressed on the cathode can provided with the gasket and net, a liquid absorber such as polypropylene non-woven fabric is put, and an electrolyte comprising lithium perchlorate, or lithium fluoborate dissolved in one or more of 1,2-dimethoxyethane, propylene carbonate, and tetrahydrofuran is dropped on it, an anode compound is provided on it, the electrolyte is

dropped so that it penetrates into the anode compound, and the anode can is fitted and sealed by crimping it inwardly.

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(3)

Herein, the anode compound consists of active materials such as manganese dioxide, iron sulfide, and carbon fluoride, with crystalline graphite, binder, etc. mixed in. In order to prevent the anode compound layer from collapsing due to external pressure, and in order to improve the current capability for collection by rendering [the anode compound layer] so that it has a more dense degree of contact with the anode can, [the anode compound layer] is formed by pressure into a disk-like form with high density. Therefore, the electrolyte was not able to quickly penetrate into the layer. In addition, because only a small amount of electrolyte was used, and because a method was adopted in which the electrolyte was dropped on the center of the disk onto which the anode compound had been applied, it took time for the electrolyte to penetrate into the anode compound. This problem therefore led to a loss of time in the process. Moreover, under a very dry atmosphere in which the relative humidity is 20% or less, the electrolyte evaporates quickly during penetration. Consequently, reductions in or variations of the cell properties due to the evaporation of the electrolyte took place. In considering of the problems noted above, the present invention is designed to so that the electrolyte is sprayed in a mist-like form onto the anode compound during the process of penetration of the electrolyte into the anode compound, which instantaneously completes the penetration process of the electrolyte into the anode compound, and prevents the electrolyte from dissipating due to evaporation.

(4)

Thus, the production time is shortened, and reductions in or variations of the cell properties due to the evaporation of the electrolyte are prevented.

In the present invention, the electrolyte is usually sprayed onto the anode compound under a pressure of  $2\text{kg}/\text{cm}^2$  to  $6\text{ kg}/\text{cm}^2$ . However, the higher the pressure is, the more favorable it is, as long as the sprayed electrolyte does not bounce off of the anode compound due to impact. In addition, it is needless to mention that, in the process of penetration of the electrolyte into the liquid absorber, the electrolyte may be sprayed in a mist-like form as well.

The figure is a graph which compares the discharge properties of Cell A and Cell B, under a temperature of  $20^\circ\text{C}$  and an external load of  $2.5\text{k}\Omega$ . Cell A was prepared according to the method of the present invention, in which metal lithium was utilized as the cathode active material, manganese dioxide was utilized as the anode active material,

and lithium perchlorate in the amount of 0.5 mol/l dissolved in a mixture of propylene carbonate, as well as 1,2-dimethoxyethane in which the ratio of propylene carbonate was 40 volume %, was utilized as the electrolyte. The corresponding electrolyte was sprayed in a mist-like form onto the anode compound, and the anode can was immediately fitted. Cell B was prepared in a manner in which the same active materials and electrolyte were utilized, and the anode can was fitted one minute after the electrolyte was dropped onto the anode compound.

(5)

As is obvious from the figure, Cell A, which was prepared according to the method of the present invention, exhibits a larger discharge volume and more stable discharge properties, as compared to Cell B, which was prepared according to the traditional method.

In order to clearly show the differences in the variations of the discharge volume between said Cell A, which was prepared according to the method of the present invention, and the said Cell B, which was prepared according to the traditional method, the duration of discharge of 5 cells from Cell A and from Cell B was measured; these results are shown below.

	Cell A	Cell B
Discharge Duration (hr)	152	185
	151	110
	152	128
	148	120
	148	187
	Average: 150	Average: 125

(6)

As is clear from the table above, the cell which was prepared according to the method of the present invention possesses a larger discharge volume, and exhibits far fewer variations in the discharge volume, as compared to Cell B, which was prepared according to the traditional method. In addition, the cell which was prepared according to the method of the present invention possesses a higher closed circuit voltage and a lower internal resistance, as compared to Cell B, which was prepared according to the traditional method.

As explained in detail above, the present invention is designed to spray the electrolyte in a mist-like form onto the anode compound, when preparing non-aqueous electrolyte cell.

According to this method, reductions in and variations of cell properties due to the evaporation of the electrolyte are prevented, a cell with fewer discharge volume variations is obtainable, and the time required for production is shortened.

#### 4. Brief Explanation of the Drawings

The figure is a graph which compares the discharge properties between the cell which was prepared according to the method of the present invention and the cell which was prepared according to the traditional method.

A----- cell which was prepared according to the method of the present invention

B----- cell which was prepared according to the traditional method



Kokai No.: 1980(Sho55)-88266 (3)

